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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/967,173	09/28/2001	Konstantin Vodopyanov	6033-007	5986

7590 02/23/2004
John F. Schipper, Esq.
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San Jose, CA 95113

EXAMINER

MENEFEE, JAMES A

ART UNIT PAPER NUMBER

2828

DATE MAILED: 02/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Applicati n No. 09/967,173	Applicant(s) VODOPYANOV, KONSTANTIN	
	Examin r James A. Menefee	Art Unit 2828	

-- The MAILING DATE of this communication appears n the c ver sheet with the correspondence address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-10,13-20,23-30 and 33-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4-6,8-10,13-15,17-20,23-25,27-30,33-35,37 and 38 is/are rejected.
- 7) ☒ Claim(s) 7,16,26 and 36 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

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Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Response to Amendment

In response to the amendment filed 12/22/2003, the specification, drawings, and claims 1, 4, 10, 13, 19, 23, 29, 30, and 33-34 are amended, and claims 2-3, 11-12, 21-22, and 31-32 are cancelled. Claims 1, 4-10, 13-20, 23-30, and 33-38 are pending.

Drawings

The drawings were received on 12/22/03. These drawings are acceptable.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claim is indefinite as it depends from cancelled claim 11.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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Claims 1, 8-10, and 17-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Komine (US 5,400,173). See especially Figs. 1, 3, and 8.

Regarding claims 1 and 10, Komine discloses a frequency converter comprising an optical cavity that is defined by a cavity axis and first and second mirrors 14, 43 spaced along the axis; a light source 11 that provides a pump laser beam wave 0 having photons with associated frequency 3ω within the cavity; a first nonlinear crystal 15 and a second nonlinear crystal 42 positioned along the cavity, and configured so that at least one pump photon passes through and interacts with the first crystal 15 and undergoes a conversion to a first-converted photon wave 1 having a frequency 2ω and a first second-converted photon wave 2 having frequency ω ; the first-converted photon wave 1 passes through and interacts with the second crystal 42 and undergoes a conversion to second and third second-converted photons waves 3 and 4 having frequencies substantially equal to ω , such that the pump photon wave 0 is converted to three photons each having a frequency substantially equal to ω . At least one of said second-converted photons exits from the cavity through the second mirror 43. The first mirror 14 is transmissive to waves 0 and 2 and reflective to wave 1, thus is transmitting at ω and 3ω and reflective at 2ω .

Regarding claims 8-9 and 17-18, the light source 11 may be Nd:YAG, and at least one crystal may be AgGaSe₂.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 19-20, 27-30, and 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komine. Komine teaches the limitations of these claims as shown in the above rejection, except does not teach that the pump beam is 4ω , which is converted in the first crystal to photons at 2ω , which are then converted in the second crystal to photons at ω . Optical parametric oscillators, such as 12 of Komine, are known that convert a beam of 4ω to a beam of 2ω . Thus, waves 1 and 2 of Komine would then each be 2ω . Such beams, when put through OPO2 (13), would be converted into four photons at ω . It would have been obvious to one skilled in the art to substitute an OPO that converts 4ω to two photons of 2ω for the OPO 12 of Komine, by matter of obvious engineering design choice. The purpose of Komine is to produce output radiations at frequencies where there are no efficient laser devices, and thus if one skilled in the art, for some particular application, needed to produce a laser having a wavelength quadruple that of a typical laser (rather than just triple as disclosed in Komine), then that skilled artisan could easily extrapolate the teachings of Komine to see that such a wavelength could be produced by the substitution outlined here.

Claims 4-6 and 13-15, 23-25, and 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komine in view of Akagawa et al. (US 5,953,154).

Komine discloses the limitations of the claims shown above, but does not disclose that one of the crystals has an AR coating as claimed, or that the mirrors may be disposed on an end of the crystals. Akagawa teaches that in an optical parametric amplifier, such as the system of Komine, the mirrors surrounding the nonlinear crystal may be disposed on the ends of the crystal

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(see Fig. 7, mirrors 30,32 on crystal 14). Though the motivation is not explicitly stated by Akagawa, it would have been obvious to one skilled in the art to dispose the mirrors on the ends of the crystals, as this would decrease the size of the system and simplify any necessary alignment of the mirrors, as is well known. Since the mirrors are transmissive to the frequencies as required by the claims, then this is equivalent to there being an AR coating on the ends for these frequencies.

Allowable Subject Matter

Claims 7, 16, 26 and 36 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. There is not taught or disclosed in the prior art a method or system for frequency multiplication as having the particular cavity length satisfying the relationship as claimed

Response to Arguments

Applicant's arguments filed 12/22/2003 have been fully considered but they are not fully persuasive.

Applicant makes a number of arguments against the rejections based on the Komine reference. Applicant first argues that because the mirror 43 is partly reflecting for λ_4 and transmissive to λ_5 , it is not possible for λ_4 and λ_5 to be substantially equal (p. 20 of response). The Examiner disagrees. "Substantially" is defined in Merriam-Webster's Collegiate Dictionary, 10th Ed., as "largely but not wholly that which is specified." Komine discloses the waves 2, 3,

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and 4, to have wavelengths of 3-3.5, 2-3, and 3-5 microns respectively. The Examiner believes it is a proper interpretation to interpret these values as “substantially equal.”

Applicant next makes three arguments on page 22: “(1) Komine...relies upon the provision of two optical cavities...(2) the wavelengths λ_4 and λ_5 of the Komine patent (Figure 8) cannot be substantially equal...and (3) the Komine patent discloses production of one photon of a frequency corresponding approximately to ω from a photon of frequency 3ω .”

Regarding argument (1), the argument is not persuasive. While it may be interpreted that each OPO 12, 13 of Komine is defined by a cavity, it may also be interpreted that the entire system is a cavity having input at the input of 12 and output at the output of 13.

Regarding argument (2), this argument is addressed above.

Regarding argument (3), the argument is not persuasive. Komine discloses the production of three photons. See Fig. 1, waves 2, 3, 4. Pumping wave 0 has a wavelength of approximately 1.0 microns, and output waves 2, 3, and 4 may each have outputs of approximately 3.0 microns. This corresponds to the production of three photons at ω from a pumping photon of 3ω .

The arguments regarding the rejection of claims 7, 16, 26, and 36 are persuasive. See “Allowable Subject Matter” above.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. These references show similar systems where nonlinear crystals produce multiple beams of different frequencies, but do not produce the frequencies as claimed.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Menefee whose telephone number is (571) 272-1944. The examiner can normally be reached on M-F 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Ip can be reached on (571) 272-1941. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JM
January 30, 2004


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